(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 085 361
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 83100482.5

(22) Date of filing: 20.01.83

(51) Int. Cl.³: F 16 D 65/12

(30) Priority: 02.02.82 IT 1941182

(43) Date of publication of application:
10.08.83 Bulletin 83/32

(84) Designated Contracting States:
AT BE CH DE FR GB LI NL SE

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(54) Disk brake.

(57) A disk brake particularly suitable for railway vehicles comprising a hub carrying a number of radial extensions and comprising a double-walled circle ring-shaped disk, suitable spacing being provided between the two mutually facing walls so as to form some air circulation ducts between them, the internal portion of the disk carrying a number of radial extensions connected with the corresponding radial extensions of the hub by means of an intervening pin-shaped coupling means engaged in such a way that the disk may freely expand radially when heated by the braking work (Fig. 1 is referred to).

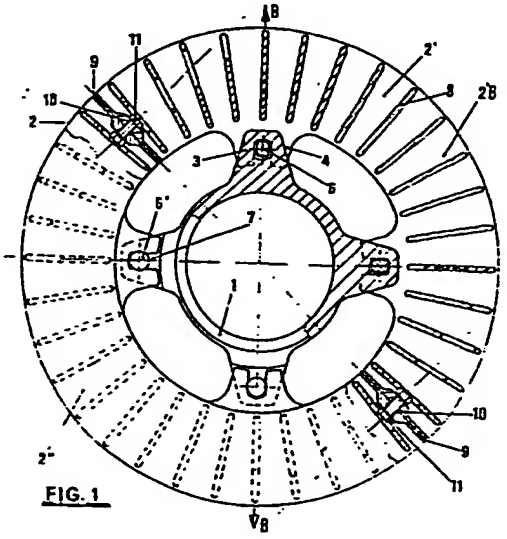

FIG. 1

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Disk Brake.

This invention relates to a disk brake designed especially for railway vehicles, comprising a hub peripherically carrying a number of radial extensions and comprising a double-walled circle ring-shaped disk, the aforementioned walls defining, on the inside, some open radial ducts and, on the outside, two surfaces designed to be tightened by the brake lining supports (hereinafter referred to simply as supports) of a braking system, the disk being made up of one or more parts of a circle ring and being provided with a number of radial extensions connected with the radial extensions of the hub. The hub is usually shrinked onto a driving axle or onto a neutral axle.

In the following specification the hub and disk as defined hereabove shall be referred to simply as -hub- and -disk- respectively.

There are various types of disk brakes currently employed for railway vehicles: the brake developed by Messrs. Bergische Stahl Industrie of Remscheid (Federal Republic of Germany) in which the disk comprises a number of radial extensions designed to fit into radial recesses of

corresponding radial extensions carried by the hub; the brake described in the Italian patent applications N. 25645 A/76 and N. 23383 A/77 where the disk is composed of two separate mutually opposed circle rings, divided into at least two parts, the mutually opposed surfaces carrying a number of extensions designed to engage an equal number of corresponding slots produced in the hub, the parts of the mutually opposed circle rings being urged to each other by means of suitable members which are also designed to secure the disk onto the hub both radially and axially; the brake described in the Italian patent N. 1,052,464 where the disk is composed of four semicircular parts of a ring that are directly secured, in pairs, to the lateral surfaces of a rotor or of a wheel which is fixed to the respective axle.

The drawbacks inherent in the first of the aforementioned brakes are due to the fact that the trasversal movement of the disk, namely its movement parallel to the axle, is not checked satisfactorily, this design relying merely on two small plates secured by a single screw, hence, should the latter break, traverse shifts of the disk with respect to the hub would possibly ensue; the drawbacks inherent in the second of the aforementioned brakes result from the fact that the members securing the disk to the hub prevent a certain portion of the disk surface from sliding radially with respect to the hub when the disk itself runs hot as a result of braking action since the aforementioned fixing members are located in the area where the abovementioned supports operate; in addition, the particular construction of this brake is rather complex and, therefore, implies

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considerable costs; the problems posed by the third of the aforementioned brakes lie in the fact that, since the two disks are mounted on the surfaces of a wheel or of a rotor, namely since there is no space for the circulation of air between the disk, a considerable thermal gradient is generated in the material while braking and, as the disks are secured to the wheel or rotor through relatively rigid couplings, the mechanical tensions produced by the thermal gradient bring the material under considerable strain, limiting the life span of the material itself.

The brake developed in accordance with this invention, as characterized in the claims, comprises a hub carrying a number of suitably spaced radial extensions and includes a circle ring-shaped disk, made up of one or more parts, in which each part consists of a double-walled enblock unit containing some open radial ducts formed by transversal radial ribs, the abovementioned disk being provided with a number of radial extensions, converging toward the centre of the ring, each of them being designed for connection with a corresponding radial extension of the hub by means of an intervening pin-shaped member (herein-after referred to simply as - pin -) which may be locked within a hollow of the relevant radial extensions of the disk so as to slide radially within a slot produced in each corresponding radial extension of the hub or, alternatively, which may be locked within a hollow of each radial extension of the hub so as to slide within the corresponding slot of the relevant radial extension of the disk, the hub and disk extensions, and the respective connections, being located in

an area other than the braking surfaces of the disk, between said surfaces and the centre of the disk, while the pin is held rigidly facing in the tangential direction in both radial extensions in order to transmit the tangential braking stress without any tangential clearance and, furthermore, each single radial extension of the disk comprising two opposite parts with a certain gap between them so as to house a corresponding radial extension of the hub, the pin being secured transversally to the plane of the disk, on the one side, by means of a head and, on the other side, by means of a screw. The aforementioned head and nut, as well as the external end of the screw, are recessed with respect to the braking surfaces of the disk to such an extent that their operation remains unaffected even after the removal of a certain amount of material from the braking surfaces as a result of the wear produced by repeated braking operations.

The advantages afforded by this invention lie in the fact that the radial sliding motion of the disk on the pin or of the pin on the hub allows the disk to freely expand radially, with respect to the hub, when the disk itself runs hot as a result of the friction produced by the braking; that steadiness of the disk on the hub in the tangential direction is ensured without any undesired clearance when the brake is operated; that steadiness of the disk on the hub in the direction parallel to the axle is ensured satisfactorily; that the design is relatively simple and, therefore, profitable.

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One way of carrying out the invention is described in detail below with reference to the enclosed drawings, which illustrate only three specific embodiments, in which:

FIG. 1 is a front view of the assembly, partly in section through A-A of FIG. 2, featuring a brake hub and disk designed in accordance with a preferred embodiment.

FIG. 2 is a scrap side view, partly in section through B-B of FIG. 1,

FIG. 3 is a front view of the connection between the corresponding radial extensions of a hub and of a disk according to a second embodiment,

FIG. 4 is a front view of the connection between the corresponding radial extensions of a hub and of a disk according to a third embodiment.

With reference to FIGS. 1 and 2, the disk brake comprises a hub 1 and a disk 2, defined by two half-parts of a circle ring 2' and 2" each covering 180° of the circle ring, each hub and each disk carrying four corresponding radial extensions 3, 4 respectively, two radial extensions for each half-part, the radial extensions 4 of the disk comprising, in turn, two members 4', 4" facing each other with a gap between them designed to house, without any considerable clearance, a corresponding extension 3 of the hub. Each extension 3 of the hub is provided with a recess 5 in which a pin 6 is forced, fixed by a head 6' and a screw 6" which

is screwed down into a parallel hole within pin 6, said pin being long enough to enter into slot 7 of extention 4, slot 7 being located at the end which is adjacent to hub 1. Each of the two parts of the circle ring 2', 2" comprises two half-parts(2'A,2'B and 2"A,2"B)which have a gap between them in the circle ring area and are, instead, brought together in the area of extension 4, ribs 8 stretching out radially across the space comprised between the two half-parts, from one face to the other. Each of the two parts 2', 2" is obtained, together with the relevant ribs 8, from an iron casting. Moreover, each of the two parts 2', 2" carries, in the area of contact 9 with the other part, a special rib 10 provided with a hole for through bolt 11 which is designed to clamp the two aforementioned parts together. As they approach said special ribs 10, the normal ribs 8 are radially reduced or are provided with an opening for the insertion of thorugh bolt 11 and of a wrench for tightening the respective nut. Each half-part 2', 2" of disk 2 comprises two radial extensions 4 with a 90° gap between them and a 45° gap from the base diameter. Pin 6 is provided with a substantially rectangular cross section so that it may rest on broad lateral supporting surfaces and may, thus, uniformly transmit any compressive stress to the members against which it rests while the brake is operated.

FIG. 3 shows how parallel pin 6 is forced into some round recesses produced in extension 4 of a disk 2 (member 4' of extension 4 is visible in this figure) and enters into a thorugh hole 12, which is suitably ovalized toward the outside of extension 3 of a hub 1. It will be realized that

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when disk 2 extends radially, pin 6 is drawn out by extension 4 and slides into the ovalized portion of hole 12.

FIG. 4 shows a pin 6, substantially rectangular in shape, as it is forced into the recesses of extension 4 of a disk 2 (member 4' of extension 4 is visible in this figure) and enters into a slot 13 of extension 3 of hub 1, slot 13 being open externally. Here, too, it is clear that when disk 2 expands radially, pin 6 is drawn outwards by extension 4 and slides into slot 13.

Another alternative to the above embodiments, which is not illustrated with a drawing as it is very simple, is similar to the one described with reference to FIG. 3: hole 12 of extension 3 is round, rather than tapered, and this alternative can be successfully employed for brakes in which the expected thermal gradient during brake operation entails such a limited radial extension of the disk, in the area where extensions 3 and 4 are connected, that the ensuing radial tensions can be absorbed by the pin of a coupling means in which no radial sliding motion is possible. It is clear that, in this arrangment, the cross section of the pin may be either round or rectangular. This design offers another advantage in that the structure of the disk brake is simplified to an even greater degree.

Claims

1. A disk brake particularly suitable for railway vehicles comprising a hub carrying a number of radial extensions and comprising a circle ring-shaped disk, composed of one or more parts, each part comprising two parallel walls between which some open radial ducts are formed which are, in turn, defined by transversal radial ribs, the aforementioned disk carrying a number of radial extensions each designed to be connected with a corresponding radial extension of the hub, said extensions being located in an area other than the braking surfaces of the disk, characterized in that a radial extension of the hub is connected with a corresponding radial extension of the disk by means of a pin set transversally with respect to the plane of the disk, which is locked within a recess of the radial hub extension and passes through a slot in the radial extension of the disk so as to slide radially within the slot when the disk extends and in that, alternatively, a radial hub extension is connected with a corresponding disk extension by means of a pin set transversally with respect to the plane of the disk, which is locked within a recess in the radial extension of the disk and enters a slot in the radial extension of the hub so as to slide radially within the slot when the disk extends.

2. A disk brake according to claim 1 characterized in that each radial extension of the disk comprises two opposed parts with a gap between them in order to house, with only very limited clearance a corresponding radial extension of the

hub, in that the pin designed to connect the radial disk extension with the radial hub extension is secured axially through its forced coupling within a recess of one of the two extensions as well as by suitable check members placed at its ends, the pin and its check members being suitably recessed with respect to the planes of the two outer disk-braking surfaces.

3. A disk brake particularly suitable for railway vehicles comprising a hub provided with a number of radial extensions and comprising a circle ring-shaped disk, made up of one or more parts, each part comprising two parallel walls between which some open radial ducts are defined which are, in turn, defined by some transversal radial ribs, the aforementioned disk carrying a number of radial extensions each of which is designed for connection with a corresponding radial hub extension, said extensions being external to the disk-braking surfaces, characterized in that a radial extension of the hub is connected with a corresponding radial extension of the disk by means of a pin set transversally with respect to the plane of the disk which pin is locked both radially and tangentially within the recesses in the radial hub extension and in the radial disk extension and in that the aforementioned pin is secured axially by suitable check members provided at its ends as well as by the coupling within said recesses, the pin and its check members being suitably recessed with respect to the planes of the two outer disk-braking surfaces.

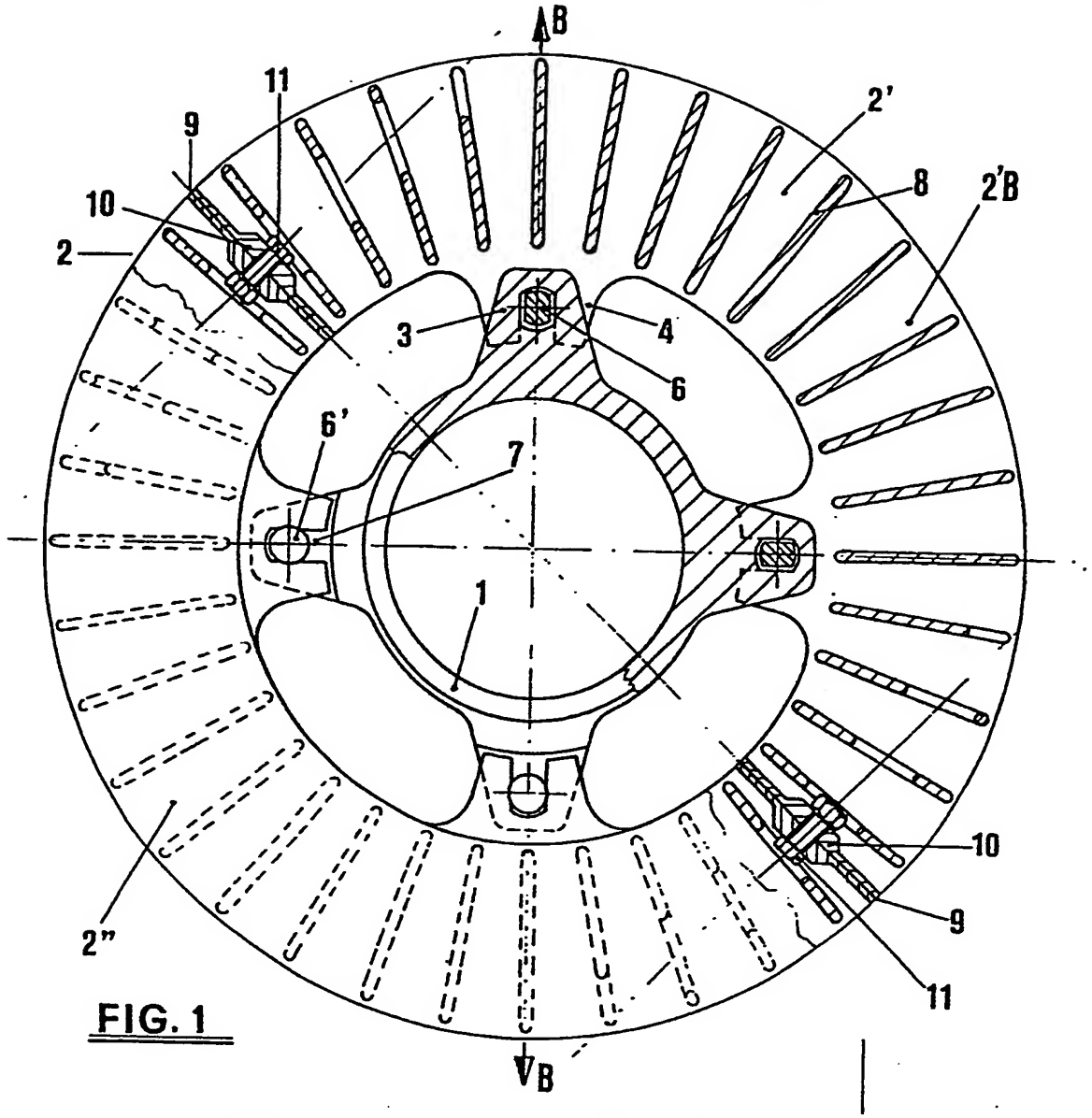

FIG. 1

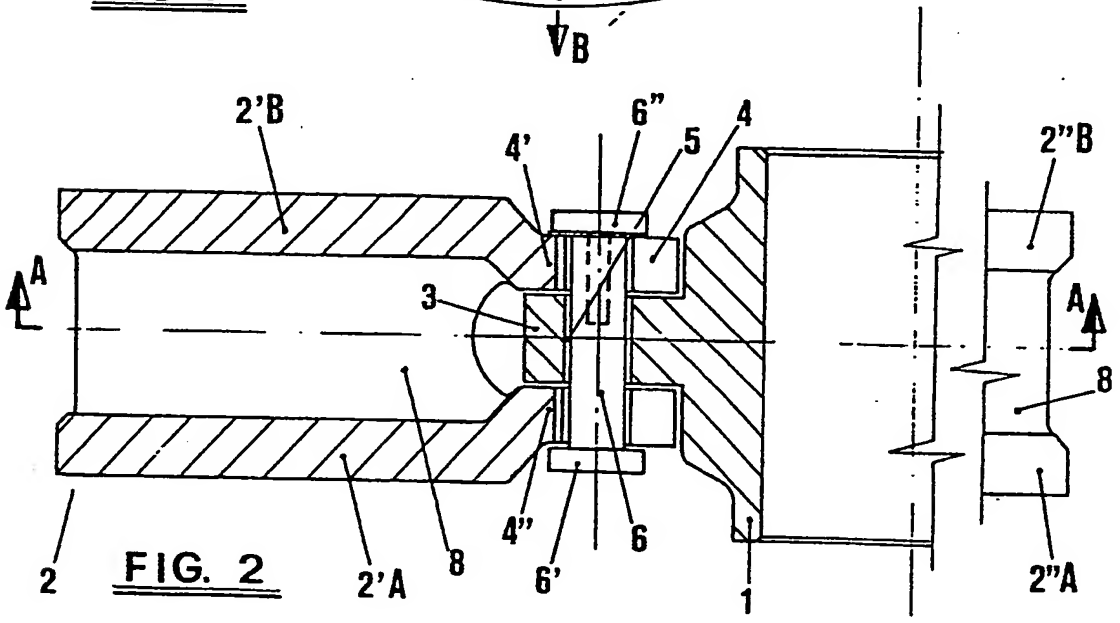

FIG. 2

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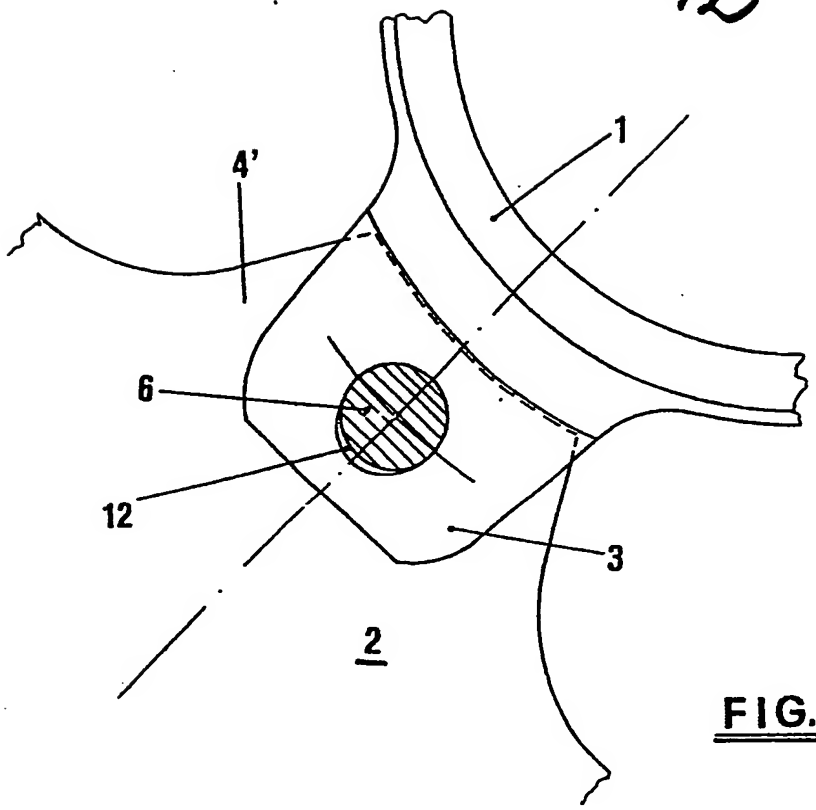

FIG. 3

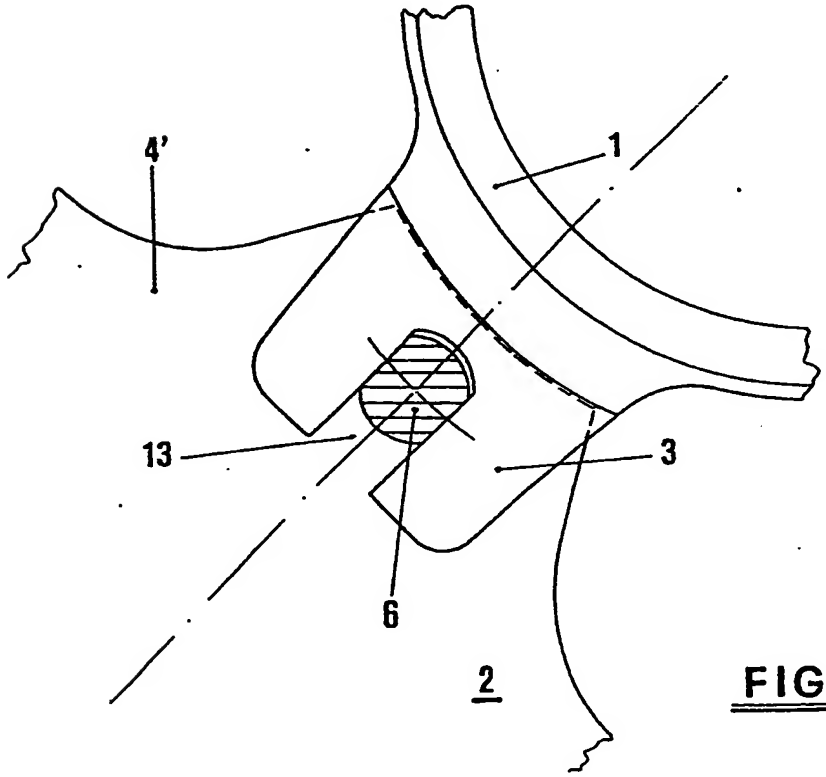

FIG. 4

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EUROPEAN SEARCH REPORT

0085361
Application number

EP 83100482.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
D,A	DE - A1 - 2 733 224 (A. POLI) * Page 8, line 24 - page 17, line 17; fig. 1-7 *	1	F 16 D 65/12
A	DE - A1 - 2 545 544 (PONT-A-MOUSSON S.A.) * Fig. 1,2 *	1	
A	DD - A - 140 577 (INSTITUT FÜR SCHIENENFAHRZEUGE) * Fig. 1-3 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

F 16 D 65/00
B 61 H 5/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	16-05-1983	ROUSSARIAN

CATEGORY OF CITED DOCUMENTS

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